

Remarks:

Claims 15-102 are pending in this application. Claims 15-19, 42, 43, 45, 57-66, 69-71, 85, and 90-102 have been cancelled without prejudice or disclaimer by way of this amendment.

***Rejection under 35 USC 112, first paragraph***

The Examiner has rejected claim 41 under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. Claims 42-56, being dependent on claim 41, were also rejected. Applicant amended claim 41. Claim 41, as amended, is now supported in applicant's original specification, for example at page 10 lines 13 through lines 27.

***Rejection under 35 USC 112, second paragraph***

The Examiner has rejected claims 15-28 and 41-56 under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter regarded as the invention.

Claim 15 was rejected because of lack of proper antecedent basis for 'core controllers. Claim 17 was rejected for improper use of the word 'segment'. Claims 16-28, which depend on claim 15 were therefore rejected. Claims 15-19 have been cancelled and claim 20 is amended to include the limitations of the base claim 15 and intervening claim 18. Antecedent issues with regard to claim 15 are removed by this amendment, and claim 17 is cancelled.

Claim 28 was rejected because the term "the packet switch" lacks proper antecedent basis. Amended claim 28 now refers to "the switch" as introduced in amended claim 20.

Claim 41 was rejected because the symbol 'n' is defined multiple times in the claim. Amended claim 41 removes reference to symbols 'n', 'm', and 'A'.

Accordingly, it is submitted that the rejections under 35 U.S.C. §112.

second paragraph, have been overcome. Applicant respectfully requests that the rejections be withdrawn.

***Rejection under 35 USC 102(b)***

Claims 15-19, 41-43, 57-64, 69, 90-95, and 98 are rejected under 35 USC 102(b) as being anticipated by Beshai, "Multi-Tera-Bit/S Switch Based on Burst Transfer and Independent Shared Buffers." Claims 15-19 are cancelled by way of this amendment.

In order to support a rejection under 35 U.S.C. §102, *every* limitation in the claims should be shown or suggested in the reference.

Claim 41 recites "...A distributed packet switch comprising ... *a plurality of cross connectors each having a plurality of outer links and a plurality of inner links* ... wherein each of said outer links connects to an edge module ... and each of said inner links connects to a core module..." No such structure is shown in Beshai; rather it is respectfully submitted that the multi-tera-bit/S switch described in Beshai uses a rotator to connect each ingress module to each core unit during successive time slots so that each ingress module can transfer a data block to each core unit during each of successive time slots. The present invention uses channel cross connectors to selectively connect the ingress modules to the core modules. The rotator in Beshai is a time-division device while a cross connector in the present invention is a frequency-division device (wavelength division device). The cross-connectors, as described in the specification, on page 11, switch channels incoming from subtending edge modules to appropriate core modules to enable the switch configuration to match traffic patterns.

Accordingly, the rejection under 35 U.S.C. §102 is improper and Applicant respectfully requests that the rejection be withdrawn. Claims 44 and 45-56 serve to add further patentable limitations to claim 41, and therefore are allowable for at least the reasons put forth with regard to claim 41.

In addition, with respect to the limitation of claim 43, which is now included

in amended claim 41, reference is made to Figure 11 in Beshai. It is respectfully submitted that Figure 11 refers to collocated core units. Claim 43 claims core modules distributed over a wide area. This requires a process of time coordination due to the varying propagation delays as described in page 13 of the specification.

Claims 57-64, 69, 90-95, and 98 have been canceled without prejudice or disclaimer.

***Rejection under 35 USC 102(e)***

Claims 15-17, 57-61, 69, 85, and 97-100 are rejected under 35 USC 103(e) as being anticipated by Ofek (US 6,385,198).

Claims 15-17, 57-61, 69, 85, and 97-100 have been canceled without prejudice or disclaimer.

Claims 90-96 are rejected under 35 USC 102(e) as being anticipated by Krishna (US 6,563,837).

Claims 90-96 have been canceled without prejudice or disclaimer.

***Rejection under 35 USC 103***

Claims 62-64 and 101-102 are rejected under 35 USC 103(a) as being unpatentable over Ofek in view of Yuan.

Claims 62-64 and 101-102 have been canceled without prejudice or disclaimer.

Claims 65-68 and 101-102 are rejected under 35 USC 103(a) as being unpatentable over Ofek in view of Yuan and further in view of Limal

Claims 65-66 are canceled without prejudice or disclaimer.

Claims 67-68 now depend from amended claim 72, believed to be allowable.

Claims 41-43 and 45-48 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ofek in view of Limal.

In order to support a rejection under 35 U.S.C. §103, every limitation in the claims should be shown or suggested in the combination of references. Applicant respectfully submits that the combination of Ofek with Limal does not support this rejection for the following reasons.

**Regarding claim 41,** the Examiner asserts that Ofek may be silent or deficient with respect to cross connects having  $n$  outer links and  $n$  inner links but Limal teaches the limitation.

It is respectfully submitted that the cross-connectors used in the system of claim 41 switch entire wavelength channels from input multi-channel links incoming from ingress modules to output multi-channel links outgoing to core modules in order to enable each ingress module to connect to any core module through at least one wavelength channel. It is not clear how such cross connectors can be used in the network of Ofek which does not use WDM links.

Furthermore, it is respectfully noted that Limal describes a wavelength-translating optical cross connector using tunable filters and tuned wavelength converters in a network based on a broadcast-and-select technique. In contrast, each cross-connector in the present invention is used to switch *each individual channel* in each multi-channel signal received from a fiber link incoming from an ingress module to a fiber link connecting the cross connector to a core module. Thus, each ingress module may connect to a large number of the independent core modules and the connectivity pattern may be adapted to time-varying traffic patterns.

Amended claim 41 includes the limitation of claim 45.

**Claim 45 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ofek in view of Limal.**

It is respectfully submitted that Ofek teaches a signaling method that is limited to a packet network in which the switches have a common time reference (CTR). Furthermore,

the method relies on a separate network to carry signaling messages. Please see col. 2, line 63 to col. 3, line 4 in Ofek.

**Neither of these two conditions is required in the method of the present invention.**

The common time reference in Ofek is realized using a Coordinated Universal Time (UTC) which is globally available via the Global Positioning System (GPS). Please see Ofek, Col. 3, lines 18-49. Further details on the use of the International Coordinated-Universal-Time (UTC) standard are provided in Col. 6, line 63, to Col. 7 line 24. The time-coordination method of the present invention does not rely on external timing systems.

Ofek describes pipeline forwarding across a virtual pipe 25 (col. 7, lines 28-34) with a predefined delay in every stage (either across a communication line 41 or across a switch 10 from input port 30 to output port 40). The method of time coordination in the present invention does not rely on a predefined delay. Instead, the method adapts to time-varying propagation delays and does not require any knowledge of the values of the propagation delays.

It is further noted that, in the network of Ofek, a path from an ingress module (a gateway) to an egress module (a gateway) forms a pipeline traversing a sequence of core modules (switches). In the present invention, the core modules are not interconnected. The core modules are totally independent and each maintains its own time reference which is not dictated or influenced by any external timing facility. The time-coordination method of the present invention relies on a time counter at each core module and at least one time counter at each ingress module.

Claims 44 and 49-53 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ofek in view of Limal and in further view of Yuan.

Claims 54-56, 70 and 71 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ofek in view of Yuan in further view of Limal.

It is respectfully submitted that no combination of Ofek, Limal, and Yuan produces the distributed packet switch as claimed in claim 41 with the limitations of claims 44, 49-56 as discussed below:

### **The Ofek reference**

Ofek describes a network of gateway switches (edge modules) connecting to a network core comprising switches (core modules) that are interconnected. A path from one gateway to another may traverse a series of switches. Ofek refers to a switch 10 experiencing delay from an input port 30 to an output port 40. (Please see col. 7, lines 28-34, in Ofek: *"Pipeline forwarding relates to data packets being forwarded across a virtual pipe 25 with a predefined delay in every stage (either across a communication link 41 or across a switch 10 from input port 30 to output port 40)."*)

### **The Limal reference**

Limal, describes an optical switch based on a broadcast-and-select technique using tunable filters and tuned wavelength converters.

### **The Yuan reference**

Yuan describes a ring-like network comprising a plurality of optical switches each optical switch having a fixed number of input and output ports. Only one input port and only one output port in each switch connect to a processing element associated with the switch. The remaining input and output ports of each switch connect to other switches through wavelength channels. Yuan illustrates the use of two wavelength channels in Figure 1 and explains that Figure 1 can also be used to demonstrate the establishment of connections in WDM networks where two different wavelengths are used for the two channels (Yuan, page 39, right column, second paragraph).

The operation of the Yuan network in a TDM mode requires that:

(a) the switches be globally synchronized at time-slot boundaries (Yuan, Section 2, first paragraph) and each switch be set to alternate between two (or more) states (Figure 2 in Yuan); and

(b) a logical shadow network be provided to communicate all the control messages (control packets). The shadow network operates in packet switching mode; routers at intermediate nodes examine the control packets and update local bookkeeping information and switch state accordingly. (Yuan, page 39, right column, last complete paragraph).

With respect to requirement (a), Applicant respectfully submits that time alignment at time-slot boundaries in the Yuan reference is very difficult to realize in a network of wide coverage due to large propagation delays. Yuan contemplates a network in which the time slot is in the order of a fraction of a microsecond (page 39, right column, first complete paragraph). The propagation delay between two nodes in a geographically distributed network may be several orders of magnitude larger than a time slot (a propagation delay of 20 milliseconds, for example, versus a time slot of a fraction of a millisecond). A slight variation in environmental conditions could lead to propagation-delay variation and, hence, a significant temporal misalignment at any of the switches. Yuan is silent with respect to providing means for resolving the time alignment issue. The network claimed in claim 41 provides time coordination through an exchange of timing packets between each edge module and each core module to which the edge module connects.

With respect to requirement (b), it is noted that the network of claim 41 does not require a separate signaling network.

The Examiner states, at page 10 of the office action "... *Ofek* is silent or deficient to the further limitation wherein each core module includes circuitry for time domain multiplexing (TDM) a plurality of ingress-to-egress module connections.... *Yuan* teaches the further recited limitation..."

Applicant's claim 41 as amended now recites "each of said edge modules exchanges timing packets with each of said core modules to accomplish time coordination". Applicant submits that the Yuan reference fails to teach or describe this element of the claim, and therefore respectfully request that the rejection be withdrawn.

Therefore, Applicant respectfully submits that claim 41 is patentably distinguishable over any combination of the *Ofek*, *Limal*, and *Yuan* references and respectfully requests that the Examiner withdraw this rejection.

Claims 44 and 49-56 depend from amended claim 41, believed to be allowable.

Claims 70 and 71 are canceled by way of this amendment.

No new matter has been introduced by way of these amendments.

#### **Allowable Claims**

Applicant thanks the Examiner for the allowance of claims 29-40 and for the indication that claims 20-28, 72-84, and 86-89 would be allowable if rewritten in independent form including all the limitations of the base claim and any intervening claims.

As indicated hereinbefore, claim 20 has been amended to include the limitations of the base claim 15 and intervening claim 18. Claims 21 and 28 have been amended to replace the term 'packet switch' with the term 'switch' as claimed in amended claim 20. Claims 21-28 depend from claim 20, believed to be allowable.

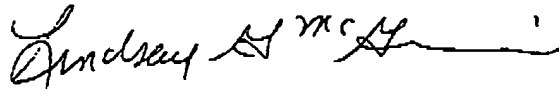
Claim 72 has been amended to include the limitations of base claim 57 and the intervening claims.

Claim 86 has been amended to include the limitations of claim 85. Claims 87-89 depend from amended claim 86, believed to be allowable.

Applicant has made a diligent effort to place the claims in condition for allowance. However, should there remain unresolved issues that require adverse action, it is respectfully requested that the Examiner telephone Lindsay G. McGuinness, Applicants' Attorney at 978-264-6664 extension 304 so that such issues may be resolved as expeditiously as possible. For these reasons, and in view of the above amendments, this application is now considered to be in condition for allowance and such action is earnestly solicited.



Respectfully submitted,

A handwritten signature in black ink, appearing to read "Lindsay G. McGuinness". The signature is fluid and cursive, with a long horizontal stroke at the end.

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